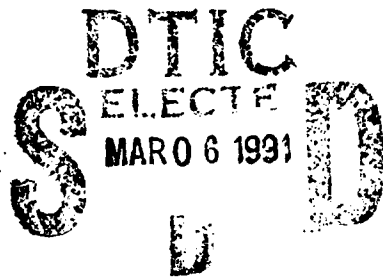


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For

**ADVANCED STUDY INSTITUTE ON THE SCIENCE & TECHNOLOGY
OF
NANOSTRUCTURED MAGNETIC MATERIALS**

Crete, Greece
June 25, 1990 to July 6, 1990



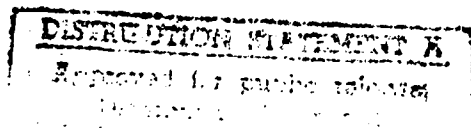
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<p>The Institute reviewed the remarkable progress made in magnetic materials over the last few years and addressed the current state-of-the-art research and its impact on technological applications. The subject matter fell into a number of broad areas including thin films, multilayers, disordered systems, ultrafine particles, intermetallic compounds, permanent magnets and magnetic imaging techniques.</p> <p>The development of new techniques for materials preparation has made a dramatic impact in the area of epitaxial growth of magnetic films. Several presentations have shown that this process can be controlled on the scale of atomic layers permitting the growth of artificial structures such as artificial superlattices with nearly atomic resolution. Epitaxial growth has also permitted the stabilization of metastable phases in thin films which often possess a strong perpendicular anisotropy.</p>					
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which may prove useful for technological applications. In magnetic multilayers and superlattices the complex coupling between different magnetic layers was discussed both experimentally and theoretically. Magnetic surfaces and interfaces show large magnetic anisotropy (surface anisotropy), coercivity, magnetoresistance, galvanomagnetic and magnetooptic effects that can lead to future storage technologies. Several contributions discussed the physics of ultrafine particles and granular solids with interesting and unique properties from superparamagnetism to strong magnetic hysteresis. The magnetic properties of rare-earth intermetallic compounds with potential applications in permanent magnets have been discussed including the crystal field effects and the origin of magnetic anisotropy. The magnetic hysteresis behavior of fine particles, permanent magnets, melt-spun ribbons and mechanically alloyed magnets have been discussed.

Finally the applications of magnetic materials in magnetic recording, magneto-optic recording and permanent magnets have been discussed with more emphasis given to the improvement of material properties for these applications.

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- I. Thin Films, Surfaces and Interfaces
- II. Multilayers
- III. Domain Walls, Magnetic Domains and Techniques for Their Observation
- IV. Magnetic Anisotropy and Random Magnets
- V. Magnetic Semiconductors and Intermetallic Compounds
- VI. Fine Particles
- VII. Magnetic Hysteresis and Permanent Magnets

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The Institute reviewed the remarkable progress made in magnetic materials over the last few years and addressed the current state-of-the-art research and its impact on technological applications. The subject matter fell into a number of broad areas including thin films, multilayers, disordered systems, ultrafine particles, intermetallic compounds, *permanent magnets and magnetic imaging techniques*.

The development of new techniques for materials preparation has made a dramatic impact in the area of epitaxial growth of magnetic films. Several presentations have shown that this process can be controlled on the scale of atomic layers permitting the growth of artificial structures such as artificial superlattices with nearly atomic resolution. Epitaxial growth has also permitted the stabilization of metastable phases in thin films which often possess a strong perpendicular anisotropy which may prove useful for technological applications. In magnetic multilayers and superlattices the complex coupling between different magnetic layers was discussed both *experimentally and theoretically*. In superlattices it was proposed that a strong coupling between two ferromagnetic layers can be carried out through an intervening layer which is not ferromagnetic. This coupling leads to new properties not seen in the past. Magnetic surfaces and interfaces show large magnetic anisotropy (surface anisotropy), coercivity, magnetoresistance, galvanomagnetic and magnetooptic effects that can lead to future storage technologies. Band structure studies using statistical techniques of Monte Carlo calculations, led to accurate calculations of the Curie temperature of Fe, Co, Ni films. The solution of this problem opened the door for other important phenomena which are due to "spin orbit" coupling. Several contributions discussed the physics of ultrafine particles and granular solids with interesting and unique properties from superparamagnetism to strong magnetic hysteresis. The magnetic properties of rare-earth intermetallic compounds with potential applications in permanent magnets have been discussed including the crystal field effects and the origin of magnetic anisotropy. The magnetic hysteresis behavior of fine particles, permanent magnets, melt-spun ribbons and mechanically alloyed magnets have been discussed. The magnetic hysteresis models of "domain wall pinning" and "nucleation of reversed domains" have been reviewed and their applicability in different magnetic materials was discussed. The micromagnetic approach using the Landau-Lifshitz-Gilbert equation was also presented to explain the hysteresis behavior of thin films.

The magnetic properties of all of these materials are strongly influenced by their microstructure and several methods to evaluate their growth, lattice structure and sample integrity were discussed. These included spin-polarized electron spectroscopy, DPC and RHEED/RE Microscopy and Lorentz microscopy.

Finally the applications of magnetic materials in magnetic recording, magneto-optic recording and permanent magnets have been discussed with more emphasis given to the improvement of material properties for these applications.

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